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FOREST INSECTS OF THE YEAR 1932

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Although but a relatively small number of insect species cause important losses in California's forested areas, the year-by-year record of these losses indicates profound local changes and variations both in species composition of the infestations and in amount of injury. Because of this, a general record of insect-caused losses is of great importance, not only as it indicates the possible developments of the future, but also because it shows the extent to which forest resources and the various phases of forestry are affected.

Practically all phases of forestry are influenced, either directly or indirectly, and to a varying degree, by the activities of forest insects. In range resources and timber production, however, the effects of insect depredations are direct and evident. For that reason we shall confine the discussion to consideration of direct losses in range resources and timber due to insect activity during the 1932 season.

INSECTS AFFECTING RANGE RESOURCES

Any insects that destroy the normal browse of range animals have a direct effect on the value of an area for grazing purposes. For this reason the periodic abundance of the California tortoise-shell butterfly (Aglais californica Edv.) and the Great Basin tent caterpillar (Malacosoma fragilis (Stretch)) is important, as it may result in nearly complete defoliation of various species of brush the foliage of which is used for food by range animals.

Van Dyke (Pan-Pac.Ent,8(2):92,1928) reported considerable flights of adult tortoise-shell butterflies in 1913 and 1926. In addition, 1910, 1911, 1931, and 1932 have been noted by others as seasons of exceptional abundance and defoliation. In 1910 and 1911 large areas of Ceanothus brushland north of McCloud, in the Shasta National Forest, were almost completely defoliated, and in 1931 the same areas, as well as other brush areas in the Lassen, Plumas, Eldorado, and Stanislaus National Forests in the Sierras, and areas in Mendocino and Humboldt Counties, suffered similar injury. In 1932 defoliation caused by the larvae of this species was evident in the same and additional areas, and an unusual flight of adults was commented on by many travelers.

The Great Basin tent caterpillar, which is often abundant on Purshia tridentata and other brush species important as sheep and deer browse in northeastern California, has suffered a decline in numbers during the past two years. Although it was sufficiently abundant to cause considerable damage in 1930, few individuals were to be found in the same areas in 1932.

INSECTS AFFECTING TIMBER PRODUCTION

Defoliators

No defoliators are of importance as immediate causes of large timber losses in California. The lodgepole needle-miner (Recurvaria milleri Busck), however, played an important role as a contributory cause of the mountain pine beetle epidemic of 1918-1921 in the Tuolumne Meadows area of Yosemite National Park. Trees were weakened by almost complete defoliation resulting from continued attacks by the needle-miner, and fell easy prey to the mountain pine beetle, which was able to build up its numbers to epidemic proportions in the defoliated stands and to wipe out practically all lodgepole of any size over a large area. Although the needle-miner has continued in extremely light infestations of some lodgepole areas in California since 1921, it is important to note that marked increases in numbers and activity were noted in one locality in Yosemite National Park this last season. Future activities of this insect may be of considerable importance to the lodgepole stands involved.

The pandora moth (Coloradia pandora Blake), which was a contributory cause of the western pine beetle epidemics in the pumice areas of southern Oregon between 1918 and 1926, usually is not of much importance in similar areas in California. The finding of adults this last season on a pumice area bearing a stand of Jeffrey pine near Mammoth in the Inyo National Forest indicates that the brood in that locality has the same cycle as that in southern Oregon; i.e., that flight occurs in the even years.

Sucking Insects

Numerous sucking insects feed to a greater or less extent on forest trees, particularly on the younger trees and on reproduction; but direct injury caused by their activities is seldom of any great importance in timber production. One scale insect (Xylococcus macrocarpae Coleman) is usually abundant on incense cedar. During 1932 an extremely heavy infestation of pole stands and reproduction occurred in the central Sierra region. Practically all individuals of some pole stands were covered with sooty fungus which grows in the honeydew produced by the scale insect, and ladybird beetles (Hippodamia convergens Guérin) were abundant during the early season and fed on the scale insects to a considerable extent. The effects of continued feeding by the scales on young trees is evident in the stands supporting large populations. The codominant and suppressed trees are weakened by the continued loss of sap, and growth is reduced. Finally the infested and weakened individuals die.

Insects Attacking the Inner Bark

Most of the forest insects of importance in California attack the subcortical areas of tree trunks and of the larger branches. Although many different species of insects are concerned, species of the beetle family Scolytidae are the most important and destructive.

Cypress Bark Beetles

Damage caused by species of the genus Phloeosinus was unusually heavy during the 1932 season in pole stands and reproduction of incense cedar in the central Sierra region and in the Warner Mountain division of the Modoc National Forest. Although there is some question as to whether or not the beetles are the primary cause of the death of trees, drought often appearing to be an equally important factor, the attacks of P.fulgens Sw. in the North Warner Mountains appeared to be the primary cause of death. In the central Sierra region the western cedar bark beetle (P.punctatus Lec.) caused extremely heavy losses in reproduction. It was apparent that the drought conditions of 1931 may have been at least a contributory cause of the death of the trees in this region.

Engraver Beetles

It is impossible to make definite statements concerning the relative intensity of the 1932 infestation of white and red firs by the fir engraver beetle (Scolytus ventralis Lec.) at this time of year, for many of the infested trees that will die as a result of the 1932 attacks have not yet become sufficiently affected to make this fact evident. Apparently, however, the heavy infestation of 1931 in the Sierra region has subsided somewhat. The fact that Coeloides brunneri Viereck, a parasite of the engraver beetle, was extremely abundant during 1932 and the fact that death of many or all of the fir engraver beetle larvae before they reached maturity was a common occurrence point to a decrease in the effectiveness of the 1932 attacks and possibly further reduction in the losses in 1933. In 1932 the losses in parts of the Modoc, Lassen, Eldorado, and Tahoe National Forests appeared to be heavier than in 1931. Typical infestation of the type now found in these forests is shown in Figure 1, a photograph taken in the Warner Mountains of the Modoc National Forest. The light-colored trees on the hillside, each of which has succumbed to attacks of the engraver beetle, are striking evidence of the intensity of the infestation.

During 1932 the large western pine engraver beetle (Ips emarginatus (Lec.)) continued to play its usual minor rôle as a primary cause of death of ponderosa pine in the east-side-type stands of the Modoc and Lassen National Forests.

The California five-spined engraver beetle (Ips confusus (Lec.)), which worked in conjunction with the western pine beetle in stands at the lower altitudes of the Sierra region and caused heavy losses in 1931, decreased markedly in importance during 1932. This insect, which normally breeds in windthrown trees, logging slash, or at the most only in the tops of green trees or in reproduction, became extremely aggressive and abundant in 1930 and 1931 and infested entire trees. This type of attack continued during the early months of activity in 1932, but by the end of the season the species had resumed its customary minor rôle.

Tree-Killing Bark Beetles

The genus Dendroctonus, which comprises the group known as the tree-killing bark beetles, contains the three most important insect species attacking the ponderosa, Jeffrey, sugar, and lodgepole pine stands of California.

The Jeffrey pine beetle (D. jeffreyi Hopk.), which is the most important insect enemy of Jeffrey pine in California, showed unusual activity in the east-side-type stands during 1932. Although losses in the pure Jeffrey pine stands in the Inyo and Mono National Forests remained fairly light, when compared with Jeffrey pine losses in the Lassen stands, there was, in August, 1932, every evidence that the attacks were more vigorous than those of the past two years and would result in greater losses.

Infestation by the Jeffrey pine beetle approached an epidemic status during 1932 in the east-side mixed-species type of stand in the Lassen National Forest. Although losses due to attacks by this beetle in the same area in 1931 were much heavier than can be considered normal, the losses in 1932 on cruised plots showed increases of from 70 to 300 per cent over those of 1931, and volume losses of nearly 3½ per cent of the stand were suffered in some areas. This condition of affairs is considered unusual, for in the past losses have seldom attained these proportions unless aided by the presence of suitable material in the form of windthrown and other down material.

During 1932 the mountain pine beetle (D.monticolae Hopk.) continued its attacks on isolated bodies of lodgepole pine scattered through the Sierras. Only in the Medicine Lake area of the Shasta National Forest does a real epidemic infestation, comparable to those in the Rocky Mountain region, exist. The type of infestation found in most lodgepole stands in California is one in which small groups of dead trees build up by the addition of one or a few infested trees each year. Although this type of infestation is not so spectacular as is that in which the front of the infestation moves steadily ahead, leaving few trees behind that have not been killed, it produces groups of snags, often of considerable size, which are unsightly and, in recreational areas, are detrimental to the uses for which these areas are intended. Successful attempts to control this type of infestation were made in Sequoia National Park during 1931, and work has recently been completed against the same type of infestation in Lassen Volcanic National Park. Work is projected for this coming spring in Yosemite National Park for infestation in lodgepole pine at Porcupine Flat, which is outside the area devastated by the mountain pine beetle infestation of 1918-1921. The lodgepole needle-miner, which was a contributory cause of the extensive losses in that series of infestations, is also present and increasing in numbers in the area for which control is planned.

The valuable sugar pine of the Sierra region also is a host of the mountain pine beetle, and losses in that species of tree due to attacks by the beetles have increased strikingly during 1932. In one small basin near the western boundary of Yosemite National Park, in which the worst infestation was found, it was estimated that about 40 per cent of the merchantable sugar pine found on a traverse through the area had been killed since 1931. In other areas the infestation did not reach this peak of destruction, but there is no reason to believe that it may not be reached in the future. The fact that sugar pine is, practically speaking, a California species, and that its timber is of great value, makes these losses of exceptional importance. Control projects planned for the spring of 1933 in two areas in the Sierra National Forest and in two areas in Yosemite National Park are to be directed toward the reduction of sugar pine losses in those areas.

Ponderosa pine, also a host of the mountain pine beetle, suffered somewhat heavier than normal losses in 1932, particularly in the east-side-type stands in the northeastern part of the state. An unusual type of infestation was found this year in the Modoc National Forest. Pole-sized pine trees in a mixed ponderosa pine-white fir stand were killed on an area several acres in extent. Practically every ponderosa pine tree on the area has been infested and killed, with the net result that the insects have changed the forest type from a mixed stand to a pure white fir stand. A similar type of infestation was reported by Keen for another area in the near vicinity in 1918.

The western pine beetle (D.brevicomis Lec.) is by far the most destructive forest insect attacking ponderosa pine in California. In the Sierra region epidemic infestations of unprecedented intensity were reported in 1931, and appalling losses were suffered in several areas. Figure 2 shows a typical infestation in one of these areas. The epidemic continued in 1932, although the areas that suffered heavily in 1931 showed decreases in the amount of loss recorded for this season, and it was evident that the broods were less vigorous than in 1931. However, areas not attacked by epidemic infestations in 1931 have for the most part suffered from increasing and heavier infestations during 1932, and some of the best stands in the state are now suffering from truly epidemic infestations. Epidemic conditions appear to have moved up to the higher elevations and into the more valuable and better-quality stands. In such areas losses of as many as 800 trees per section were recorded in 1932, and the future of the stands does not look bright.

In some local areas of the Santa Barbara National Forest, where there is a restricted-type cover of ponderosa and Coulter pine, infestation conditions are reported to be similar to those of the Sierra region. The infestation apparently increased in intensity during 1930 and 1931, with western pine beetles and engraver beetles cooperating in the initial attacks. In 1932 large groups of infested trees appeared and losses continued to be heavy. Although of no commercial value, these areas are for the most part important from a recreational standpoint, and the loss of much of the forest cover is threatened.

In northeastern California, more particularly in the east-side-type stands in the Lassen and Modoc National Forests, western pine beetle infestations have continued to cause heavy losses. It appears that another cycle of epidemic infestations similar to that of 1924-1928 is at hand in the Modoc National Forest. Estimates in 1932 on about 382,000 acres in the Lava Beds area place the loss at about 100,000,000 board feet, which represents about $394,000 worth of timber at stumpage prices.

During this past season there has been but one favorable development in the western pine beetle infestations in the northeastern part of the state. Recent examinations have shown that the extremely low temperatures of December have resulted in a partial mortality of the brood within the bark of infested trees. The mortality, although varying considerably in different trees, and apparently greatly affected by many factors such as altitude, exposure, and thickness and tightness of bark, was found to average 65 per cent of the western pine beetle brood in the Badger Unit of the Modoc National Forest. Examination of a limited number of samples from near Soldier Mountain in the Shasta National Forest, the Big Valley Mountains, Glass Mountain, and the North Warner Mountains in the Modoc National Forest also revealed considerable mortality of broods, due to freezing. However, the exact extent and degree of this beneficial mortality have not been determined.

GENERAL LOSS ESTIMATES FOR 1932

Any estimates attempting to fix the loss due to forest insects in California timberlands in any year must, because of the smallness of the sample it is possible to secure in any one season, be based largely on impressions rather than facts. However, some idea of the severity of the blow delivered to timber resources by forest insects can be obtained by general estimates of this type; and for that reason the following is offered:

Normal losses in timber, due to the activities of forest insects within the State of California, have been estimated at about 500,000,000 board feet per year. The losses for 1931 were estimated, on the basis of results from cruises made during that year, at about 1,250,000,000 board feet. Although the infestation of 1932 has decreased markedly from that of 1931 in some areas, it has increased just as markedly in areas where, although fewer trees have been killed, the volume losses are heavier because the killed trees are of larger size. In addition, a general although at times slight increase occurred over extensive areas during 1932, and the losses in the northeastern part of the state have more than made up for the lighter losses in the relatively few areas in the Sierra region in which the infestation has declined. On this basis, and considering the results from the 10,000 acres cruised during the 1932 season, it does not seem at all radical to estimate the 1932 losses at about a billion and a half board feet.

If the timber value of the trees killed by forest insects were the only loss, we might consider that a figure of $4,500,000 would represent the entire loss caused by forest insects in 1932. The aesthetic values of the timber in recreational areas, however, cannot be definitely given; and therefore the insect-caused losses in national parks and other recreational areas remain to be added to the total given above.

EFFORTS AT CONTROL OF FOREST INSECTS

The picture of developments in forest entomology during 1932 would not be complete without some account of the attempts that have been made and are being made by private owners and governmental agencies to stop the drain on the capital resources represented by timber, and to protect values of recreational areas by means of forest-insect control work. The formal program carried out in the winter of 1931-32 involved eight projects in the Modoc, Shasta, Eldorado, Stanislaus, and Sierra National Forests, projects in the Lassen Volcanic, Yosemite, and Sequoia National Parks, and other smaller projects in timber and recreational areas of the state. Although it is impossible at this time to give final estimates of the success of these projects, there is little doubt that the results from this work have been satisfactory.

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ILLUSTRATIONS TO ACCOMPANY ARTICLE ON
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Figure 1 (page 5) - (7494b) - Scolytus ventralis infestation in the Warner Mountains, Modoc National Forest, Calif.

Figure 2 (page 9) - (6489) - Infestation by the western pine beetle and the five-spined engraver beetle at Cascadel, Sierra National Forest, Calif.